Safety Performance Indicators

National Energy Board

Office national de l'énergie

Focus on Safety

A Comparative Analysis of Pipeline Safety Performance

2000 - 2002

January 2004

National Energy Board

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A Comparative Analysis of Pipeline Safety Performance 2000 - 2002

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FOREWORD

The information contained within this report on the safety performance of oil and gas pipelines regulated by the National Energy Board under the *National Energy Board Act* has been collected from two sources:

- incident reports submitted pursuant to the Onshore Pipeline Regulations, 1999, and
- from information provided voluntarily by pipeline companies under the Safety Performance Indicators (SPI) initiative.

All data provided is for 'pipelines' as defined by the *National Energy Board Act*. For the purposes of this report, a 'pipeline' means a line that is used for the transmission of oil or gas and that connects a province with any other province or extends beyond the limits of a province or the offshore area and includes all branches, extensions, tanks, reservoirs, storage facilities, pumps, racks, compressors, and loading facilities. As such, the report does not include data pertaining to the safety performance of pipelines carrying commodities other than hydrocarbon liquids and natural gas.

Any comments or question pertaining to this report or the SPI initiative in general can be directed to:

Ms. Karen Duckworth
Operations Compliance
National Energy Board
~~444~~ - 7th Ave. S.W.
Calgary, Alberta
T2P 0X8

Toll Free: 1-800-899-1265
Direct: 403-299-3669
Facsimile: 403-292-5503
Email: kduckworth@neb-one.gc.ca

Note: This report includes data comparisons with external reference organizations. Wherever possible, the definitions and reporting criteria employed by external reference organizations have been provided. Referenced organizations have been provided with a copy of this report. The Board thanks these organizations for their assistance in the preparation of this report.

EXECUTIVE SUMMARY

Focus on Safety is the second in a series of annual reports on the safety performance of oil and gas pipeline companies regulated by the National Energy Board (the Board or the NEB) under the *National Energy Board Act* (the Act).

The data presented in this report may be used to assess quantitatively the safety performance of NEB-regulated pipeline companies. To assist in this assessment, the Board has identified six key indicators:

1. Fatalities;
2. Ruptures;
3. Injury Frequency;
4. Liquid Releases;
5. Gas Releases; and
6. Unauthorized Activities on the Right of Way.

Performance indicators can provide valuable information pertaining to the effectiveness of safety programs. By identifying areas that show declining performance and, correspondingly, areas where performance is improving, programs can be adjusted to provide the most efficient allocation of safety resources.

Fatalities

There were no fatalities recorded by NEB-regulated pipeline companies during the reporting period from 2000 to 2002.

Ruptures

The number of ruptures reported by NEB-regulated pipeline companies increased to three in 2002 from two in 2001. The primary causes of ruptures among NEB-regulated pipelines are metal loss (corrosion) and cracking. Similarly, metal loss is the leading cause of pipeline incidents and failures identified by the Alberta Energy and Utilities Board and the U.S. Office of Pipeline Safety. The primary cause of pipeline incidents reported by the European Gas Pipeline Incident Data Group is external interference (third party damage).

A secondary causal trend cannot be clearly identified for NEB-regulated pipeline ruptures based on the most recent 10 years of data. The Alberta Energy and Utilities Board and the U.S. Office of Pipeline Safety have identified the second leading cause of pipeline failure on their facilities as external interference.

Injury Frequency

Injury frequencies (employee and contractor injuries combined) reported by NEB-regulated pipeline companies for 2000 to 2002 are consistent with frequencies reported by external reference organizations.

In 2002, company employees of NEB-regulated pipeline companies experienced an injury frequency of 0.16 for every 100 full time equivalent workers[1]. In 2000, company employees of NEB-regulated pipeline companies experienced an injury frequency of 0.23 per 100 full time equivalent workers. This figure rose to 0.87 in 2001.

The contractor injury frequency in 2002 was 1.92 injuries per 100 full time equivalent workers. Though this figure remains higher than that reported by reference organizations for the same period, the rate represents a significant decrease over the 2001 (5.35) data and is comparable to the 2000 (1.69) figures.

Liquid Releases

The number of hydrocarbon liquid releases (spills) reported by NEB-regulated pipeline companies increased to 76 in 2002 from 55 in 2001. The 2002 and 2001 figures are significantly lower than the 265 spills reported in 2000. The number of spills reported in 2002 and 2001 appears to be more representative of industry averages, while the number of spills reported in 2000 was anomalous due to high levels of construction activity. The volume of hydrocarbon liquid released in 2002 is roughly one third the amount released in 2001.

Gas Releases

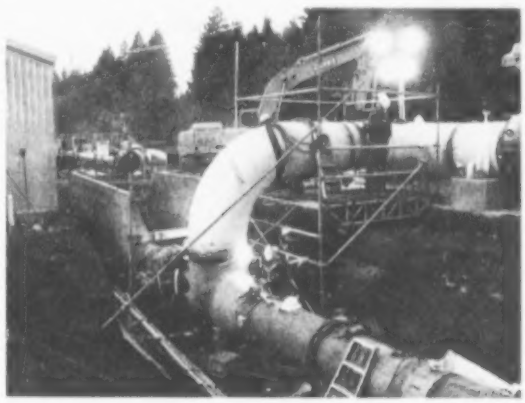
The overall number of gas releases reported by NEB-regulated companies (13 releases) showed a decrease in 2002. Gas releases remained relatively constant between 2000 (23 releases) and 2001 (29 releases). All gas releases by NEB-regulated pipeline companies, including those in stations and gas processing plants, are reportable incidents regardless of the volume or effects. Data from the U.S. Office of Pipeline Safety are for pipeline incidents where there has been death, hospitalization or gross costs of more than US$50,000. Data from the European Gas Pipeline Incident Data Group do not include releases within stations and represents only losses from the pipe body. As such, a comparison between U.S. and European data appears reasonable as the types of releases reportable would be primarily releases from the pipe body, including ruptures. A comparison of the European data and the U.S. data with NEB-regulated pipeline company releases from the pipe body reveals similar performance between all three organizations.

Unauthorized Activities on the Right of Way

To provide a better representation of incidents occurring on pipeline rights of way, all incidents reported to the Board during 2002, 2001 and 2000 were reviewed and re-categorized.

1 100 full time equivalent workers = 200 000 hours worked.

The number of overall unauthorized activities reported to the Board decreased significantly to 25 in 2002 from 51 in 2001 and 49 in 2000. Incidents resulting in contact to the pipeline itself remained at one for both 2002 and 2001, down from two in 2000. Eighty percent of the unauthorized activities reported to the Board per year reflect construction and landscaping resulting in soil disturbance on the pipeline right of way. Of these incidents, two thirds are a result of contractor activity. Over the three years, 100% of construction and landscaping incidents not resulting in soil disturbance were caused by landowners.



Conclusion

The comparison of safety performance data between the NEB and the chosen reference organizations remains problematic. However, the publication of annual performance data as presented within *Focus on Safety* provides the opportunity to compare trends between organizations on both an annual and a historical basis.

Overall, the Board is satisfied with the safety performance of the federally regulated pipeline industry within Canada. As the volume of data collected and presented within this report grows, the Board believes that the report will become increasingly valuable as a tool to refine and further improve safety performance.

The Board notes that the contractor injury frequency rates reported in 2002 are lower than those reported in 2001 and are more consistent with the levels reported in 2000. The Board will continue to monitor contractor safety practices in the field and through the Board's audit program over the coming years to evaluate improvements in contractor safety performance.

In addition, the Board is confident that the elevated number of liquid hydrocarbon spills reported in 2000 were due to elevated construction levels.

The Board recognizes that the value of reports such as *Focus on Safety* can only be judged by organizations and individuals who use or reference the data and analysis presented within this report. The Board is confident of the success, and looks forward to the continued improvement of this report with the participation of NEB-regulated pipeline companies and organizations referenced within this report.

INTRODUCTION

1.1 The National Energy Board

The NEB's purpose is to promote safety, environmental protection and economic efficiency in the Canadian public interest within the mandate set by Parliament, in the regulation of pipelines, energy development and trade.

The Board regulates the design, construction, operation and abandonment of interprovincial and international pipelines within Canada. The Board also holds regulatory authority and oversight over matters such as the tolls and tariffs of interprovincial and international pipelines, the construction and operation of international power lines and designated interprovincial electric power lines, the exports of oil, electricity and natural gas, and the exploration and development of oil and gas resources in non-Accord[2] frontier areas.

1.2 Safety Performance Indicators

Performance indicators are used throughout industry and government to assess the performance of specific sectors or departments relative to other sectors or departments. In addition, performance indicators can, over time, provide valuable information pertaining to the effectiveness of safety programs. By identifying areas that show declining performance, and correspondingly, areas where performance is improving, regulatory and company programs can be adjusted to provide the most efficient resource allocations to improve safety performance.

In 1999, the Board initiated discussion with the Canadian Energy Pipeline Association (CEPA) and the Canadian Association of Petroleum Producers (CAPP) to determine what measures could be used to assess the safety performance of the pipeline industry. The goal of these consultations was to develop meaningful, comparable and useful performance indicators that could be derived from generally available data. As a result of these discussions and data submitted by NEB-regulated companies, the first Safety Performance Indicator Report, *Focus on Safety – A Comparative Analysis of Pipeline Safety Performance*, was published in April 2003. The Board intends that the Safety Performance Indicator report be an annual report, published in January each year.

2 Those parts of Canada outside the provinces or the Yukon for which the Federal Government has the right to dispose of or exploit the natural resources.

Table 1.1 provides a detailed list of data that the Board has determined through consultation to be useful for the measurement of safety performance and for the tabulation of Safety Performance Indicators. Companies are encouraged to provide comments or to suggest improvements to the report.

TABLE 1.1

Safety Performance Data

Information Currently Reported Under NEB Regulations	**Additional Information Required Under SPI Initiative**
Serious Injuries	Company Work Injury
Hydrocarbon Liquid Spills >1.5 m^3	Contractor Work Injury
Gas Releases	Company Employee Hours
Fatalities	Contractor Worker Hours
Pipeline Ruptures	Company Employee Safety Training Hours
Unauthorized Activites on the Right of Way	Hydrocarbon Liquid Spills ≤1.5 m^3
Length of Regulated Pipeline Systems	

COMPARATIVE DATA

2.1 Reference Organizations

The following organizations have been selected for comparison purposes within this report:

- Office of Pipeline Safety - United States Department of Transport (OPS);
- Bureau of Labor Statistics - United States Department of Labor (BLS);
- Alberta Energy and Utilities Board (EUB);
- Canadian Association of Petroleum Producers (CAPP);
- Pipe Line Contractors Association of Canada (PLCAC);
- European Gas Pipeline Incident data Group (EGIG);
- CONCAWE, the European Oil Companies Association for Environment, Health and Safety (CONCAWE);
- International Association of Oil and Gas Producers (OGP); and
- National Energy Board, activities regulated under the *Canada Oil and Gas Operations Act* (COGOA).

Detailed information on reference organizations including web addresses, report references and data can be found in Appendix A.

Table 2.1 provides a listing of reference organizations and how their data is used for comparative purposes within this report.

TABLE 2.1

Comparative Data by Source

Organization	Ruptures	Fatalities	Injury Frequency	Liquid Releases	Gas Releases	Unauthorized Activities on the Right of Way
OPS				X	X	
BLS			X			
EUB				X	X	
CAPP			X			
PLCAC			X			
EGIG					X	
CONCAWE				X		
OGP		X	X			
COGOA			X			
NEB	X	X	X	X	X	X

2.2 Limitations of Comparative Data

Very few of the reference organizations used within this report publish comparisons of their own data with the data of other reporting organizations. This may be due to the fact that the definitions of terms such as 'injury' or 'rupture' are not exactly comparable between organizations. As such, comparisons made within this report may include some degree of inaccuracy. However, over time, trends should be comparable regardless of variables in definitions.

The Board is publishing *Focus on Safety* on the assumption that comparisons with external reference organizations provide value and context for the data presented in this report.

KEY INDICATORS

The Board has identified six 'key indicators' that provide meaningful, comparable and useful information on safety performance. The six indicators are:

1. Fatalities;
2. Ruptures;
3. Injury frequency;
4. Liquid releases;
5. Gas releases; and
6. Unauthorized activities on the right of way.

The criteria for each indicator are provided in the following sections, and the comparative analysis is provided in Chapter 4. Reporting requirements have been paraphrased. For exact reporting requirements, please refer to the applicable regulatory instrument.

3.1 Fatalities

Fatalities resulting from pipeline activities cause immediate tragic effects. They can also result in significant changes to legislation, regulations and to industry codes and standards.

Fatality data is typically reported as the number of contractor, company employee and third party fatalities. Within this report, fatalities that have occurred among NEB-regulated oil and gas pipeline companies are reported by number per year.

For reporting purposes, fatality data provided by NEB-regulated pipeline companies is separated into three categories:

1. Employee fatalities

   These are company employee fatalities occurring during periods where the company employee was actively involved in activities associated with his/her duties.

2. Contractor fatalities

   These are contractor fatalities occurring during periods where a contractor who is performing work for a pipeline company is actively carrying out activities pursuant to a contract with that company.

3. Third party fatalities

   These are fatalities involving persons other than pipeline contractor personnel or company employees (most commonly the general public). As such, the third party fatalities are not normalized by work hours.

Comparison of the absolute number of fatalities between reference organizations does not provide meaningful information regarding safety performance. Reference organizations such as OGP report on more than 1 billion hours of work each year. In contrast, the total work hours on NEB-regulated pipelines reported under the SPI initiative were 6.5 million in 2002, 6.4 million in 2001 and 13.3 million in 2000.

3.2 Ruptures

Ruptures are defined as a "loss of containment event that immediately impairs the operation of the pipeline". These events may pose severe risks to safety and the environment due to the high consequences associated with the spontaneous and uncontrolled release of the contents of the pipeline. In addition, the cause of ruptures may be due to systemic issues pertaining to the materials or operation of the pipeline system.

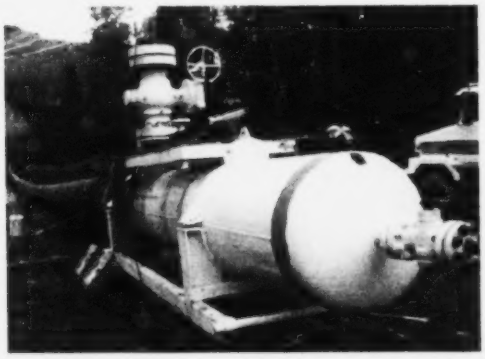
The Pipeline Risk Assessment Steering Committee (PRASC) developed the following definitions for 'leak' and 'rupture' which, in the interest of standardization, will form part of the reporting requirements for incidents reported to the NEB:

Leak	Loss of containment event that does not immediately impair the operation of the pipeline.
Rupture	Loss of containment event that immediately impairs the operation of the pipeline.

These definitions can be found within the Pipeline Risk Dictionary, which is included as Annex H of Canadian Standards Association (CSA) Z662-03, *Oil and Gas Pipeline Systems*. (Though included in the standard, use of the annex is not mandatory.)

Data from the Alberta Energy and Utilities Board (EUB) presented within this report is not limited to ruptures and represents pipeline failures that include 'leaks' and 'breaks'.

The data obtained from the Office of Pipeline Safety (OPS) is for incidents that undoubtedly include ruptures, but which also includes other incidents where the associated cost of the incident exceeds US$50,000 or where death or injury requiring hospitalization has occurred. It also includes voluntary reports. OPS incidents included in the data may include non-rupture events where more than 8 cubic metres of pipeline liquids were released. Note that as of 7 February 2002, the volume constituting a reportable release was reduced to 5 gallons (19 litres).



The data obtained from European Gas pipeline Incident Data Group (EGIG) is for pipe body releases and does not distinguish leaks from a rupture.

A comparison of the terms used within each reference organization is provided in Table 3.1.

TABLE 3.1

Comparison of Reporting Criteria for Ruptures

Source	Reporting Requirements
NEB	Rupture Loss of containment event that immediately impairs the operation of the pipeline
OPS	Incident Gas releases that were associated with a death or personal injury requiring hospitalization, or a total cost of $50,000 (U.S.) or more, or deemed significant by the operator Or Loss of eight or more cubic metres or where property damage costs exceed US $50,000 or After 7 February 2003; a release of 5 gallons (19 litres) or more
EUB	When a leak or break occurs in a pipeline, the licensee shall immediately cause the Board to be informed of the location of the leak or break 'Break' means a rupture in any part of a pipeline and 'leak' means the escape of substance from a pipeline
EGIG	Incidents include any unintentional release of gas that occurs on an onshore steel pipeline operating at greater than 1500 kPa outside of the fenced boundaries of installations and excluding all components except the pipeline

3.3 Injury Frequency

Injury frequency data is collected by most companies. This information can be used by the companies to target specific areas of their operations for improvement and allow for more efficient allocation of resources within their safety programs.

The Injury frequency rate is commonly reported as the number of lost time injuries per 100 full time equivalent workers (i.e. number of injuries per 200 000 hours) or as the number of injuries per 1 million hours. For the purposes of this report, the injury frequency rate has been presented as 'Injuries per 100 Full Time Equivalent Workers'. For calculation purposes, it is assumed that 100 full time equivalent workers will work 200 000 hours each year.

The total number of hours worked reported under the SPI initiative is 6.5 million hours in 2002, 6.4 million hours in 2001and 13.3 million hours in 2000. The drop in hours from 2000 can be attributed to a number of factors including:

- refinements in reporting practices;
- industry restructuring (such as mergers and acquisitions); and
- large scale construction projects in 2000.

Some error in injury frequency can also be introduced when making comparisons to reference organizations due to differences in how 'injury' is defined. The definition of an 'injury' for the purposes of this report is:

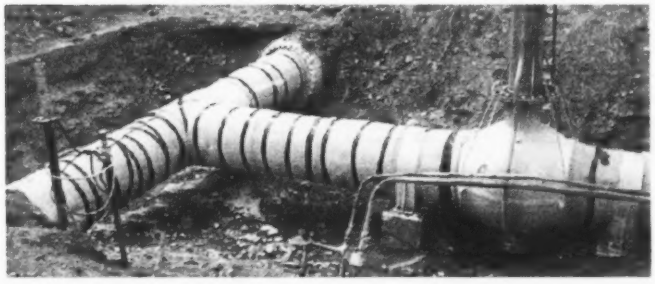
> "any occupational injury (including fatal injury) that: prevents an employee from reporting for work or from effectively performing all the duties connected with the employee's regular work on any day subsequent to the day on which the occupational injury occurred, whether or not that subsequent day is a working day for that employee".

Table 3.2 provides a summary of the 'injury' definitions used by reference organizations.

3.4 Liquid Releases (Spills)

Hydrocarbon liquid releases can have serious environmental and safety related effects. The nature of the product released may result in the formation of explosive or poisonous vapour, gas plumes, or severe environmental damage. The Board is interested in assessing the performance of industry in the operation and safe containment of hydrocarbon liquids within the pipeline system.

The number and relative volume of liquid releases reported under the SPI initiative includes spills associated with construction and maintenance activities. Therefore, the number of releases does not strictly represent releases from the pipe body or from the pipeline system as a result of failure.



The reporting criteria for liquid releases varies between the external data sources referenced in section 2.1 of this report. These differences are summarized in Table 3.3.

The volumes associated with spills of 1.5 cubic metres or less on NEB-regulated pipelines cannot be reliably determined from available data provided for 2000 and 2001, though reporting of volumes has improved for 2002.

3.5 Gas Releases

Releases of natural gas may occur as a result of loss of containment through the failure of the pipe body or components within the pipeline system. Natural gas releases may also occur through the routine functioning of equipment as well as through seepage at flanges through gaskets.

The reporting criteria for a gas release varies between the external data sources referred to in section 2.1 of this report. These differences are summarized in Table 3.4.

TABLE 3.2

Injury Definitions of Comparative Data Sources

Organization	Definitions	Comment
BLS	Data presented is taken from data for "heavy construction, except highway" and from "gas production and distribution" for injuries resulting in "days away from work, days of restricted work activity, or both"	Heavy construction data should be roughly comparable to contractor data under the SPI initiative. Gas production and distribution data should be comparable to company employee data.
CAPP	Data represents "job-related injuries that were fatal or where the worker could not return to work the next scheduled workday"	CAPP members are primarily upstream oil and gas companies and data may not be directly comparable to pipeline transportation companies.
PLCAC	Any work-related personal injury or illness that results in time loss from work. Time loss begins on the day subsequent to the day the accident occurs.	PLCAC data does not include non-union pipeline contractor data. Mainline construction data should be roughly comparable to contractor data under the SPI.
COGOA	Data represents 'loss time injuries' that prevent an employee from reporting for work or from effectively performing all the duties connected with the employees regular work on any day subsequent to the day on which the injury occurred, whether or not that subsequent day is a working day for the employee.	The definition is identical to the definition used under the SPI initiative.
NEB	Under the OPR, 'serious injury' includes an injury that results in: the fracture of a major bone; the amputation of a body part; the loss of sight in one or both eyes; internal hemorrhage; third degree burns; unconsciousness; or the loss of a body part or function of a body part. Under the SPI initiative, injury includes - "Any occupational injury (including fatal injury) that prevents an employee from reporting for work or from effectively performing all the duties connected with the employees regular work on any day subsequent to the day on which the injury occurred, whether or not that subsequent day is a working day for the employee."	The example provided as guidance to companies by the NEB is "medical aid where the employee can not return to work the following day regardless of the day of the week or injury".
OGP	Injury s referred to as a Lost Workday Case (LWDC). Any work related injury or illness other than a fatal injury that results in a person being unfit for work on any day after the day of occurrence of the occupational injury. "Any day" includes rest days, weekend days, leave days, public holidays or days after ceasing employment.	

TABLE 3.3

Comparison of Liquid Release Reporting Criteria

Source	Reporting Requirements
NEB	Any unintended or uncontained release of liquid hydrocarbons in excess of 1.5 cubic metres.
OPS	Loss of eight or more cubic metres or where property damage costs exceed US$50,000, or After 7 February 2003: a release of 5 gallons (19 litres) or more.
CONCAWE	The minimum spill size has been set at 1 m^3 for reporting purposes unless there are exceptional serious safety / environmental consequences as a result of a <1m^3 spill
EUB	When a leak or break occurs in a pipeline, the licensee shall immediately cause the Board to be informed of the location of the leak or break. 'Leak' means the escape of substance from a pipeline and 'break' means a rupture in any part of a pipeline.

TABLE 3.4

Comparison of Gas Release Reporting Criteria

Source	Reporting Requirements
NEB	Any unintended or uncontrolled release of natural gas.
OPS	Gas releases associated with a death or personal injury requiring hospitalization, or a total cost of US$50,000 or more.
EGIG	Any unintentional release of gas that occurs on an onshore steel pipeline operating at greater than 1500 kPa outside of the fenced boundaries of installations and excluding all components except the pipeline.
EUB	Leak means the escape of substance from a pipeline and break means a rupture in any part of a pipeline.

Given that the majority of gas releases occur at mechanical connections such as flanges, the exclusion of station releases within the EGIG data has significant effects when making direct comparisons with the NEB data, which includes any unintended release of natural gas, such as releases within compressor stations, metering facilities and gas processing plants.

3.6 Unauthorized Activities on the Right of Way

Unauthorized activities that are reported to the NEB under the *Pipeline Crossing Regulations (Part I or Part II)* include activities that have the potential to damage a pipeline or that may impede access to a pipeline for maintenance or emergency response. To provide a better representation of incidents occurring on pipeline right of ways, all incidents reported to the Board during 2000, 2001 and 2002 were reviewed. As a result of the review, new incident categories were established.

Unauthorized activities or events[3] considered to be indicators of pipeline safety performance with respect to damage prevention include:

1. movement of vehicles or equipment over pipelines,
2. construction, or landscaping that does not result in soil disturbance or pipeline damage;
3. construction, landscaping or grading that results in soil disturbance;
4. construction, landscaping or grading that results in pipeline damage.

There appears to be no equivalent data available from external organizations that can be readily compared with an unauthorized activity or event occurring on the right of way.

3 An unauthorized activity or event occurs on the right of way without the permission of the pipeline company or without proper notification being given to a pipeline company after permission has been granted.

ANALYSIS

4.1 Fatalities

Fatalities among NEB-regulated pipeline companies are presented in Figure 4.1. The graph has been modified from the April 2003 report. Research has revealed an additional fatality that occurred in 1991 resulting from construction activities.

The last recorded fatalities on NEB-regulated pipelines were in 1997. Both fatalities that year involved contractors working on pipeline construction projects. The last fatality to a member of the public occurred in 1985 when a plough installing drainage tile struck an operating gas transmission pipeline resulting in a rupture and killing the operator of the plough.

Figure 4.2 provides a contrast between the SPI data and that of the International Association of Oil and Gas producers (OGP) for 2002, 2001 and 2000. Given the small sample size and the zero fatality rate among NEB-regulated pipeline companies, no conclusions may be drawn from the comparison provided by Figure 4.2.

4.2 Ruptures

Figure 4.3 shows the number of ruptures reported by NEB-regulated pipeline companies between 1991 and 2002. The graph has been modified from the April 2003 report. Research has revealed an additional rupture that occurred in 1991.

FIGURE 4.1

NEB Pipeline Fatalities

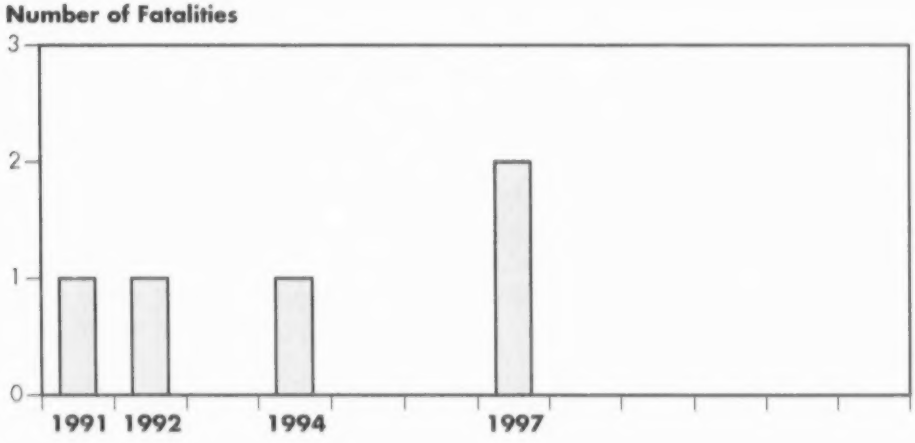


FIGURE 4.2

Fatality Frequency

Fatalities per 100 Full Time Equivalent Workers

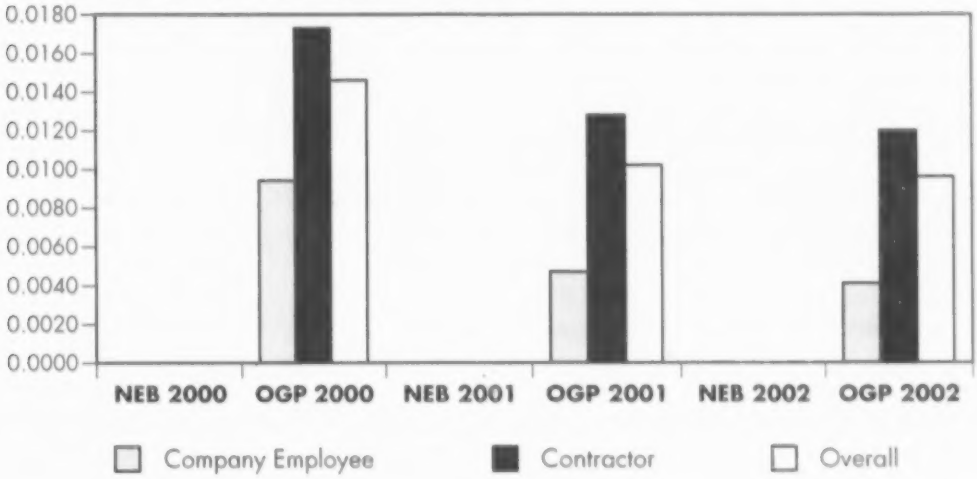


FIGURE 4.3

Number of Ruptures Reported by NEB-Regulated Pipeline Companies

Number of Ruptures

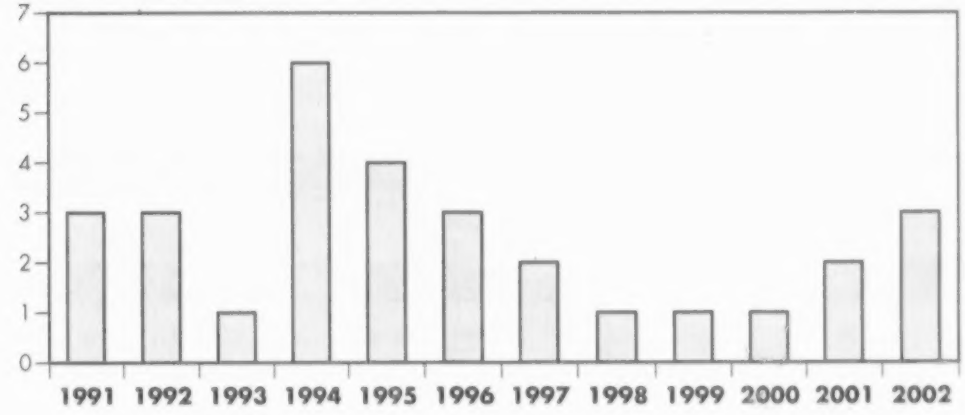


Figure 4.4 shows the causes of ruptures on NEB-regulated pipelines based on data for the referenced period. The number of ruptures recorded by NEB-regulated pipeline companies increased to three in 2002 from two in 2001. Eight of the 27 ruptures that occurred on pipeline systems regulated by the NEB between 1991 and 2001 were attributed to metal loss (corrosion) and 10 were attributed to cracking[4]. Note that stress corrosion cracking (SCC) failures are not separated from other types of cracking for the purposes of this report.

Metal loss is the leading cause of pipeline incidents and failures identified by both the Alberta Energy and Utilities Board and the U.S. Office of Pipeline Safety. The leading cause of pipeline incidents reported by the European Gas Pipeline Incident Data Group is external interference (third party damage).

4 Cracking includes SCC, HAC, mechanical damage delayed cracking, corrosion fatigue and cracking. (see Annex H.1, CSA 2662-03, *Oil and Gas Pipeline Systems*).

A secondary causal trend cannot be clearly identified for NEB-regulated pipeline ruptures based on the most recent 10 years of data. The Alberta Energy and Utilities Board and the U.S. Office of Pipeline Safety have both identified the second leading cause of pipeline failure as external interference.

Figure 4.5 provides a comparison of NEB ruptures with failures and incidents reported by the EUB, the OPS and the EGIG. The OPS data is based on reported incidents for 1997 thru 2001. The EUB data is based on data from 1980 thru to 2002. Data for EGIG is based on the period from 1970 to 2001.

Corrosion (internal and external combined) remains the leading cause of failure among the North American reference organizations shown in Figure 4.5. In Europe, EGIG records indicate the leading cause of pipeline incidents is external interference. This is consistent with the second leading cause of failure within the EUB and the OPS. External interference accounts for 27% of OPS incidents and 14% of EUB leaks and breaks. On NEB-regulated pipeline systems, external interference accounts for 4% of ruptures.

FIGURE 4.4

Causes of Ruptures on NEB-Regulated Pipelines (1991 - 2001)

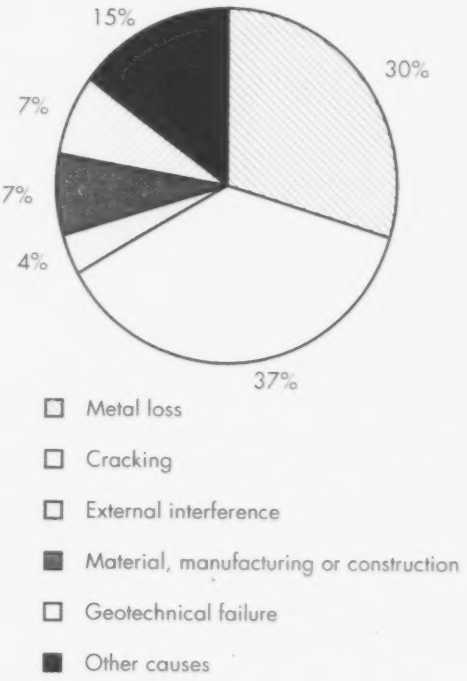
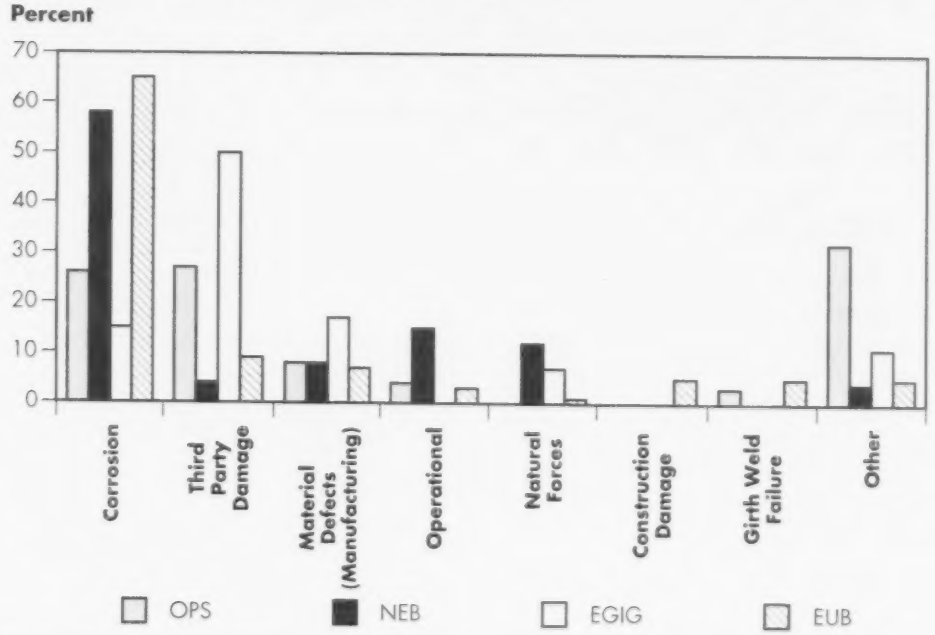


FIGURE 4.5

Comparison of Leak/Break/Rupture by Cause



Differences in pipeline content and purpose (i.e. gathering, transmission, distribution) make exact comparisons difficult but may account for differences in rupture or failure modes. The population density in the U.S. and Europe is significantly greater than in Canada, which may account for the level of ruptures caused by external interference. The density of the pipeline network regulated by the EUB coupled with high levels of construction activity in the oil and gas sector in Alberta may account for higher third party damage rates in Alberta.

Internal corrosion has not been separated from external corrosion for comparison in Figure 4.5. Internal corrosion is the leading cause of pipeline failures in Alberta. This may be attributed to the unrefined and corrosive nature of products gathered by upstream oil and gas producing companies regulated by the EUB, many of which are small diameter sour gas lines. The majority of NEB-regulated pipelines are long distance, large diameter transmission pipelines carrying processed gas and crude oil that are less corrosive in nature than those carried by pipelines regulated by the EUB.

The Pipeline Risk Dictionary, which is available as Annex H of CSA Z662-03 *Oil and Gas Pipeline Systems*, has been used to define the cause of the ruptures on NEB pipelines and has been used in Figure 4.4. Each incident has been reviewed so that the definition from the risk dictionary could be applied to the original cause definition. The intent of applying the risk dictionary definition is to provide consistency and in no way changes the original conclusions as to cause. These definitions have not been used by other organizations. As such, the causes used in Figure 4.5 reflect the causal factors in common usage.

4.3 Injury Frequency

The injury frequency rates for 2000 - 2002 are shown below in Figure 4.6.

The injury frequency rate for contractors and company employees dropped significantly in 2002. Contractor injury frequency decreased in 2002 to 1.92 per 100 full time equivalent workers, compared to 5.35 injuries per 100 full time equivalent workers in 2001 and 1.69 injuries per 100 full time equivalent workers in 2000.

FIGURE 4.6

NEB Pipeline Injury Frequency (SPI Data)

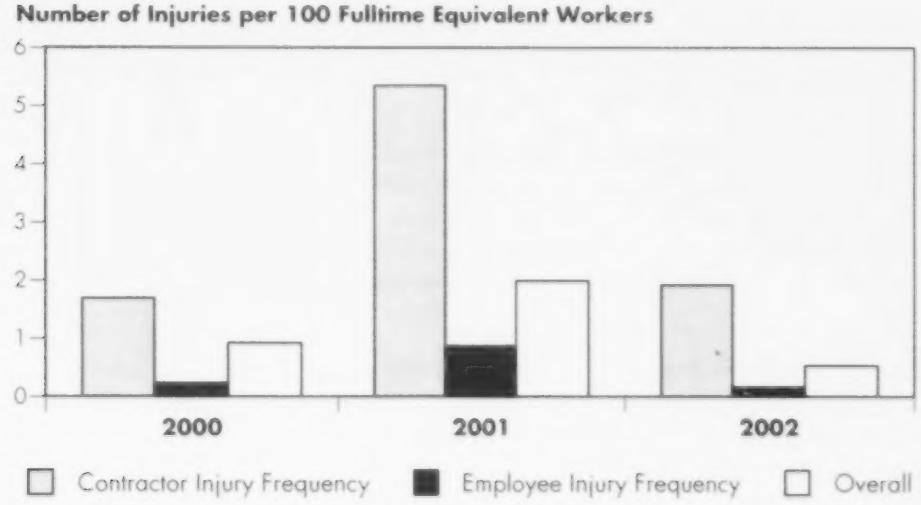
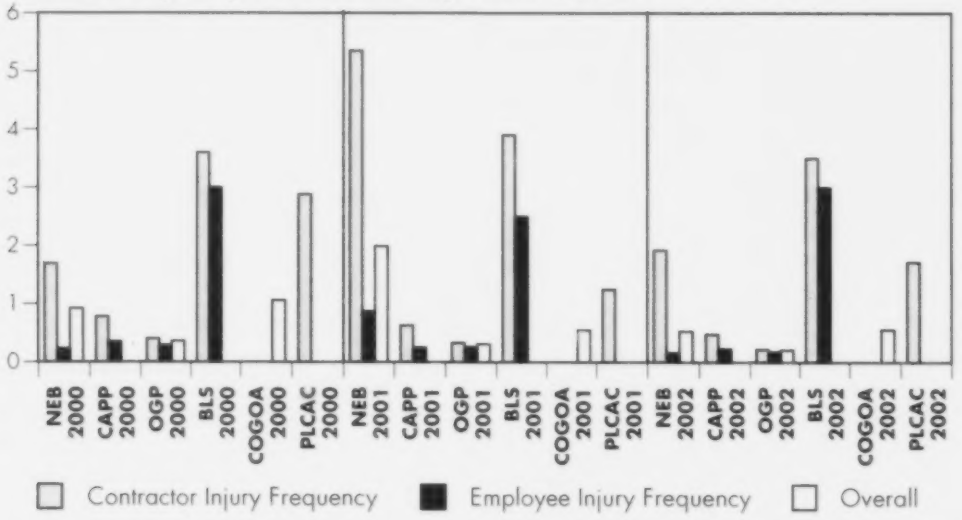


FIGURE 4.7

Comparative Injury Frequencies

Number of Injuries per 100 Fulltime Equivalent Workers



Company employee injury frequencies decreased to 0.16 per 100 full time equivalent workers in 2002 from 0.87 injuries per 100 full time equivalent workers in 2001 and 0.23 injuries per 100 full time equivalent workers in 2000.

Contractor and employee hours in 2002 are roughly comparable to the hours reported in 2001. The total number of hours worked (contractor and company employee combined) decreased from 13.3 million hours in 2000 to 6.4 million hours in 2001. Some of this decrease can be attributed to the completion of a major pipeline construction project in 2000. Company employee hours for the same period decreased from approximately 7.0 million to 4.8 million hours. This equates to roughly a 31% decrease in company employee hours from 2000 to 2001.

When contrasted with data obtained from the reference organizations, the SPI data (company employee and contractor employee data combined) appears to compare favorably with the performance of these external reporting agencies and shows an improvement over the 2001 data. Figure 4.7 provides this comparison.

4.4 Liquid Releases

Spills between reference organizations can be contrasted based on their frequency and their volume. Figure 4.8 provides a comparison of the spill frequency in excess of 1.5 cubic metres on liquids pipelines reported by NEB-regulated pipeline companies transporting liquids, with spills 1 m^3 or more reported by CONCAWE, the OPS and the EUB. The differences in reporting volumes is not statistically significant, but provides a relative comparison of liquid releases from the pipe body.

Since the impact of spills is directly related to the volume and type of fluids released, efforts have been made to compare spill volumes per kilometre of pipeline. Unfortunately, because the reporting criteria differ between reference agencies, direct comparisons are impossible. Spill volumes on NEB-regulated pipelines for 2002 have been included with the spill data. However,

approximately 14% of reported spills in 2000 were less than 1.5 cubic metres, and 9% of the reported spill in 2001 had no volume estimates.

Prior to 2 February 2002 the volume and number of spills less than 8 cubic metres were unavailable from the OPS. After that date, volumes greater than 5 gallons (19 litres) have been reported. Though the frequency of spills reported to the OPS has increased, the total spill volume has decreased slightly from the 2001 volumes.

On average, the frequency of spills reported by EUB-regulated pipeline companies as shown in Figure 4.8 is typically greater than the frequencies reported by the NEB or other reference organizations. However, as shown in Figure 4.9, the volume of fluids released, normalized over the pipeline system length, is much lower among EUB regulated companies. These pipelines are

FIGURE 4.8

Spill Frequency (Liquids Pipelines)

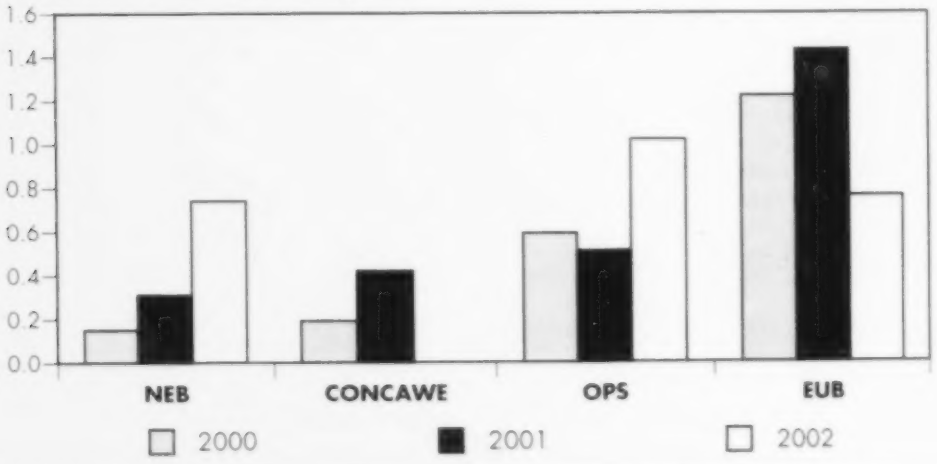


FIGURE 4.9

Spill Volumes

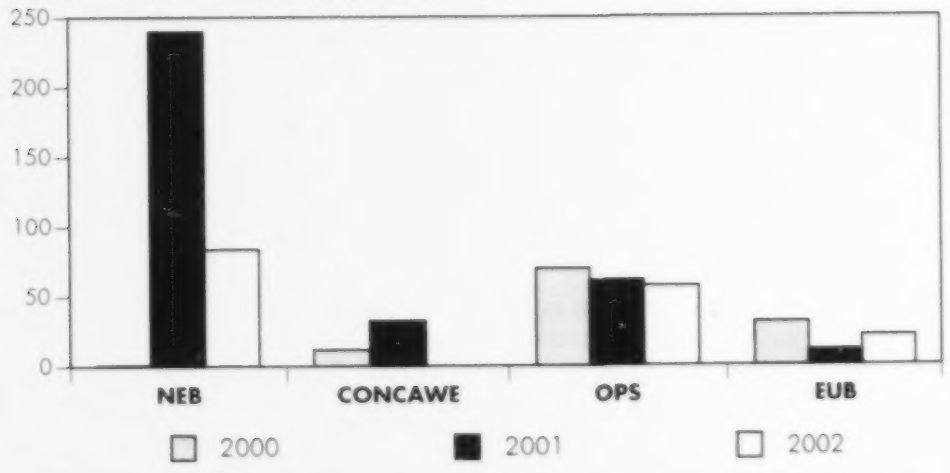
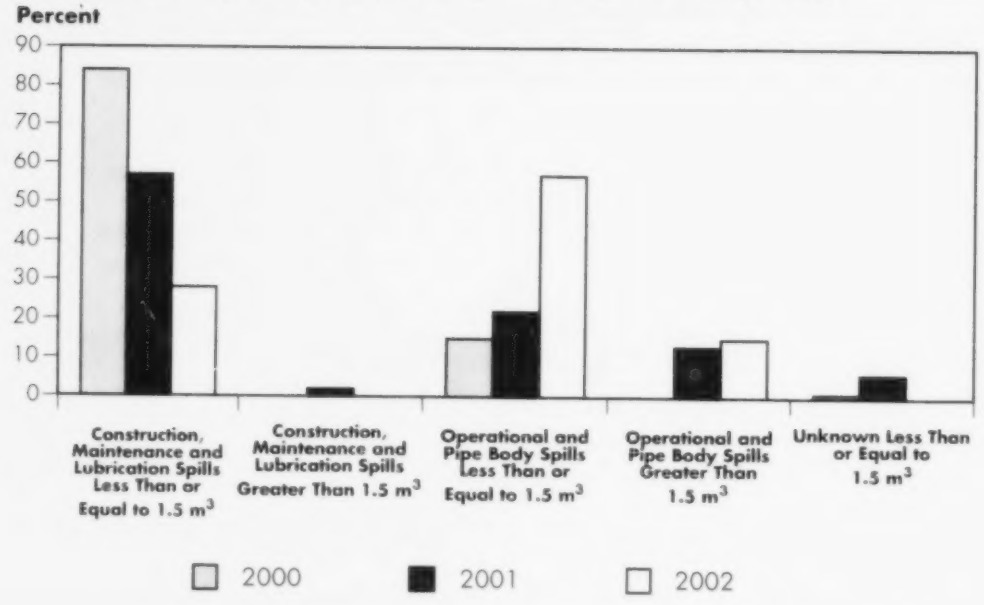


FIGURE 4.10

Reported Spills by Category (NEB-regulated Pipeline Companies)



predominantly small diameter, upstream gathering lines carrying unrefined (and often corrosive products) as opposed to large diameter transportation systems carrying proccessed gas and crude oil that are more typical of the pipelines regulated by the NEB. Further, all spills (regardless of volume) are reportable under EUB requirements. This explains the variances shown in Figures 4.8 and 4.9.

Figure 4.9 provides a comparison of spill volumes per 1000 kilometres between the reporting agencies referenced in Figure 4.8.

The causes of spills reported by NEB-regulated pipeline companies are presented in Figure 4.10. There has been an increase in operational and pipe body spills less than 1.5 cubic metres over the three reporting years. This could be attributed to a better understanding of the reporting requirements. Spills related to construction, lubrication and maintenance have decreased over the three reporting years, reflecting a significant decrease in construction activity.

The cumulative percentage of spills experienced among NEB-regulated pipeline companies by cause is presented in Figure 4.11. The figure clearly shows that the majority of reported spills (70%) are related to construction, maintenance and lubrication activities.

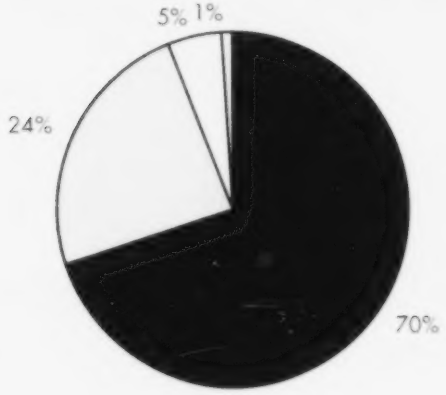
4.5 Gas Releases

The number of pipe body gas releases per 1000 kilometres of NEB-regulated gas pipeline companies is contrasted with data from EGIG and the OPS in Figure 4.12.

The data presented in Figure 4.12 is for gas releases from the pipe body of natural gas pipeline companies. Under the *Onshore Pipeline Regulations, 1999*, gas releases on NEB-regulated pipeline systems are reportable regardless of volume. This includes leaks at fittings and flanges and includes stations and gas processing plants as opposed to simple line pipe. However, the incident reports have been filtered so that the data represented in Figure 4.12 are for pipe body releases only.

FIGURE 4.11

Cumulative Spills by Category
(NEB-Regulated Pipeline Companies 2000 - 2002)

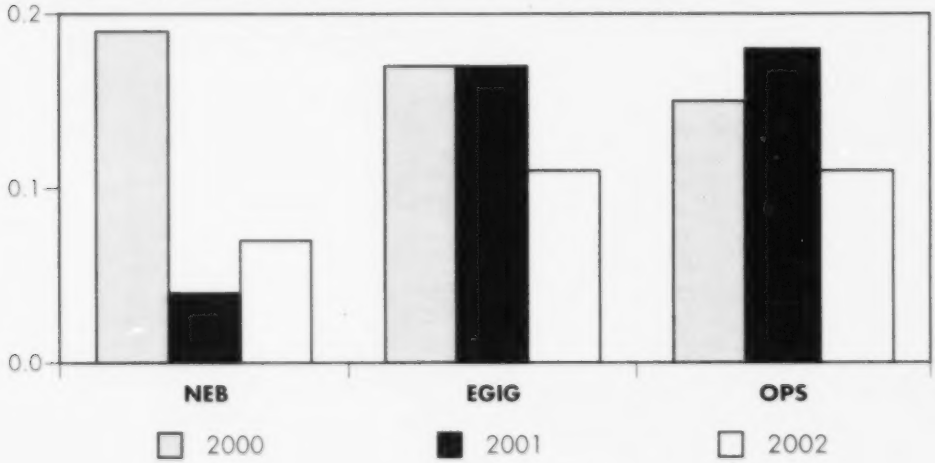


- Construction, Maintenance and Lubrication Spills $\leq 1.5\ m^3$
- Construction, Maintenance and Lubrication Spills $> 1.5\ m^3$
- Operational and Pipe Body Spills $\leq 1.5\ m^3$
- Operational and Pipe Body Spills $> 1.5\ m^3$

FIGURE 4.12

Number of Gas Releases (Gas Pipeline Companies)

Number of Pipe Body Gas Releases per 1000 km (Gas pipelines)



4.6 Unauthorized Activities on the Right of Way

The number of reported occurrences of activities having the potential to damage a pipeline or interfere with pipeline maintenance for 2002, 2001 and 2000 are shown in Figure 4.13. There has been a significant decrease in reported incidents to 25 in 2002 from the 51 incidents reported in 2001. As shown in Figure 4.13, approximatelly two thirds of those incidents were a result of contractor activity.

Figure 4.14 shows the above incidents categorized by type of activity. Incidents resulting in contact to the pipeline itself remained at one event. Construction, landscaping or grading activities resulting in soil disturbance remains a significant cause of reported right of way incidents at roughly 80% of all reported incidents.

FIGURE 4.13

Unauthorized Activities on the Right of Way by Category

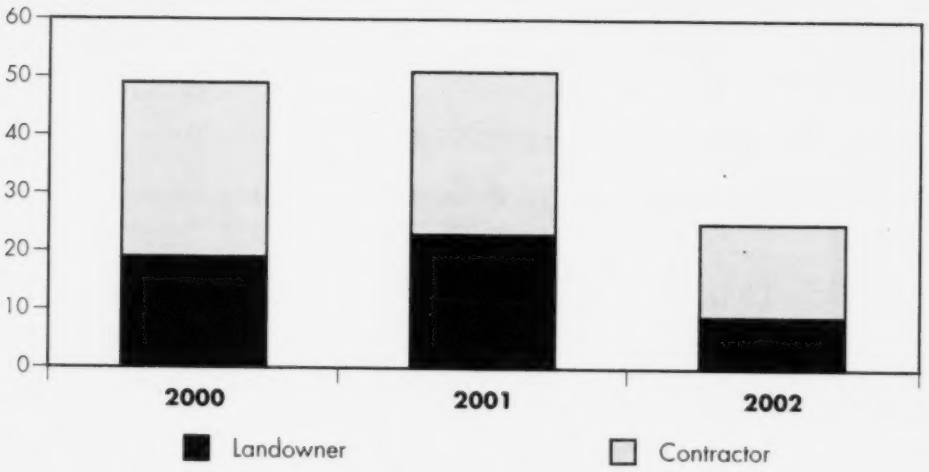
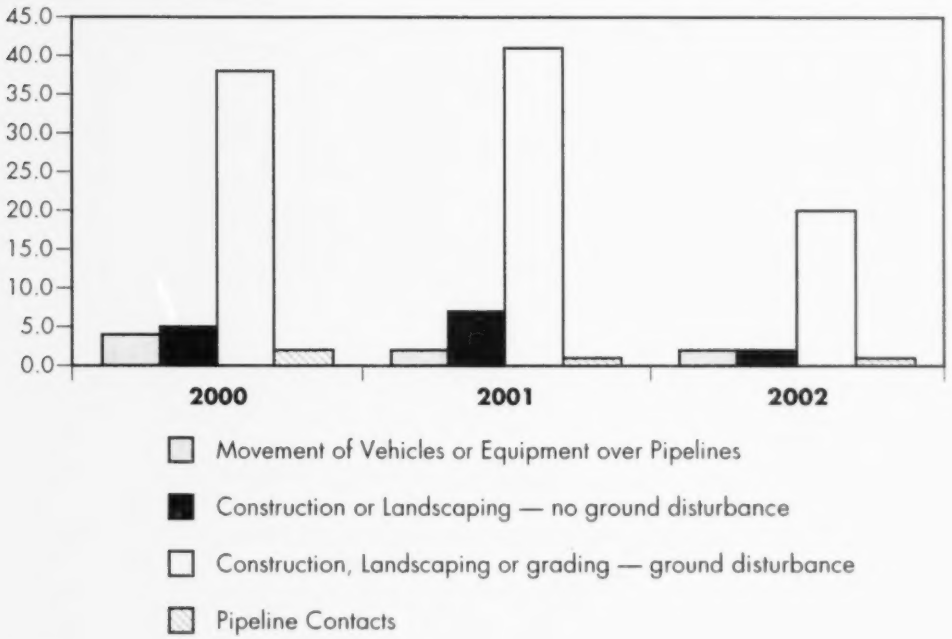


FIGURE 4.14

Unauthorized Activities on the Right of Way by Category (Cumulative Average)



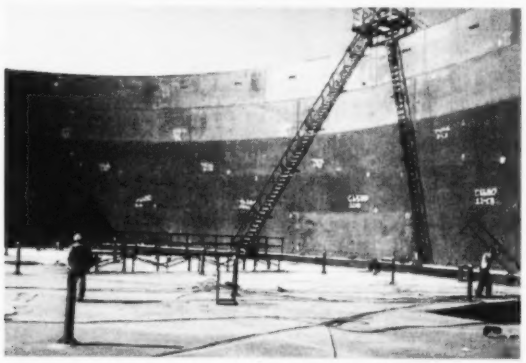
A1. Reference Organizations

Organizations chosen for comparative analysis of data within this report have been selected based on their similarities to the NEB. Sources of reference data are evaluated on an ongoing basis and may be subject to change in future editions of this report.

A1.1 Office of Pipeline Safety – United States Department of Transport

Website: www.ops.dot.gov

The Department of Transportation's Research and Special Programs Administration, acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities.



OPS safety jurisdiction over pipelines covers more than 3 000 gathering, transmission, and distribution operators as well as some 52 000 master meter and liquefied natural gas operators who own and/or operate approximately 1.6 million miles of gas pipelines, in addition to over 200 operators and an estimated 155 000 miles of hazardous liquid pipelines. (For the purposes of this report, only information on gas transmission and hazardous liquids pipelines has been used.)

OPS data is presented within this report for comparative purposes for the following key indicators:

- Liquid Releases; and
- Gas Releases.

A1.2 Bureau of Labor Statistics - United States Department of Labor

Website: www.bls.gov

The Bureau of Labor Statistics (BLS) is the principal fact-finding agency for the Federal Government of the United States in the broad field of labour economics and statistics. The BLS is an independent

national statistical agency that collects, processes, analyzes, and disseminates essential statistical data to the American public, the U.S. Congress, other Federal agencies, State and local governments, business, and labour. The BLS also serves as a statistical resource to the Department of Labor.

BLS data must satisfy a number of criteria, including relevance to current social and economic issues, timeliness in reflecting today's rapidly changing economic conditions, accuracy and consistently high statistical quality, and impartiality in both subject matter and presentation.

BLS data is presented within this report for comparative purposes for the following key indicator:

- Injury Frequency.

A1.3 Alberta Energy and Utilities Board (EUB)

Website: www.eub.gov.ab.ca

The Alberta Energy and Utilities Board (EUB) is an independent, quasi-judicial agency of the Government of Alberta. Its mission is to ensure that the discovery, development, and delivery of Alberta's resources takes place in a manner that is fair, responsible, and in the public interest.

The EUB regulates the safe, responsible, and efficient development of Alberta's energy resources including oil, natural gas, oil sands, coal, and electrical energy.

Regulation is done through four core functions: adjudication and regulation, applications, surveillance and enforcement, and information and knowledge.

EUB data is presented within this report for comparative purposes for the following key indicators:

- Ruptures; and
- Liquid Releases.

A1.4 Canadian Association of Petroleum Producers (CAPP)

Website: www.capp.ca

The Canadian Association of Petroleum Producers (CAPP) represents more than 140 member companies who explore for, develop and produce over 97% of Canada's natural gas, crude oil, oil sands and elemental sulphur.

CAPP data is presented within this report for comparative purposes for the following key indicator:

- Injury Frequency.

A1.5 Pipeline Contractor Association of Canada (PLCAC)

Website: www.pipeline.ca

The Pipe Line Contractors Association of Canada (PLCAC) represents contractors in labour relations matters and establishes training courses for the development of Canadian workers in special pipeline construction skills.

PLCAC interests and activities extend to issues such as occupational health and safety, legislative review, pipeline standards and codes and a host of other activities.

PLCAC data is presented within this report for comparative purposes for the following key indicator:

- Injury Frequency.

A1.6 European Gas Pipeline Incident Data Group (EGIG)

Website: www.gastransportservices.nl/egig

In 1982 six European gas transmission system operators took the initiative to gather data on the unintentional releases of gas in their pipeline transmission systems. This co-operation was formalized by the setting up of EGIG (European Gas pipeline Incident data Group). Now EGIG is a co-operation between a group of nine major gas transmission system operators in Western Europe and is the owner of an extensive gas pipeline-incident database.

The creation of this extensive pipeline-incident database (1982) has helped pipeline operators to demonstrate the safety performances of Europe's gas pipelines. This information has helped the pipeline operators to improve safety in their gas pipeline transmission systems.

Considering the number of participants, the extent of the pipeline systems and the exposure period involved (from 1970 onwards for most of the companies), the EGIG database is a valuable and reliable source of information. The regional differences are not taken into account so that the result of the database presents an average of all participating companies.

EGIG data is presented within this report for comparative purposes for the following key indicators:

- Gas Releases; and
- Ruptures.

A1.7 CONCAWE, the European Oil companies Association for Environment, Health and Safety (CONCAWE)

Website: www.concawe.be

Most oil companies who refine crude oil in Western (OECD) Europe are members of CONCAWE. CONCAWE is founded as an international association with a scientific objective and without profit-making intent. The organization produces sound economic, technical and scientific information.

CONCAWE data is presented within this report for comparative purposes for the following key indicator:

- Liquid Releases.

A1.8 International Association of Oil and Gas Producers (OGP)

Website: www.ogp.org.uk

The International Association of Oil and Gas Producers (OGP) is a worldwide association of oil and gas companies involved in exploration and production. OGP members include private and state-owned oil and gas companies, national associations and petroleum institutes. OGP's purpose is to:

- provide information to interested bodies on the oil and gas exploration and production industry;
- represent member's interests at global and regional regulatory bodies; and
- develop operating guidelines.

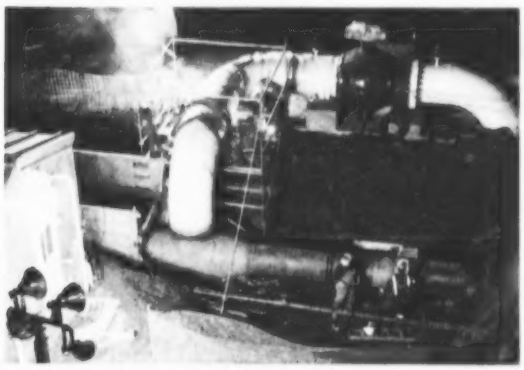
OGP data is presented within this report for comparative purposes for the following key indicators:

- Injury Frequency; and
- Fatalities.

A 2.1 Data

A2.1.1 Sample Size

Data for the period 1 January 2002 to 31 December 2002 was submitted voluntarily to the Board from 33 companies . The companies that provided data for the SPI initiative owned or operated approximately 97% of the total length of pipelines regulated by the NEB under the *National Energy Board Act*.



The length and number of companies reporting are contrasted with the overall length and number of companies regulated by the NEB under the Act in Table A2.1.

TABLE A2.1

NEB-Regulated Company Statistics

Year	No. Companies Reporting	No. Kilometres Reporting	Total Kilometres
2000	24	39 190	42 720
2001	37	42 670	42 920
2002	33	41 555	43 050

Table A2.2 provides comparative data for the reference organizations cited within this report.

TABLE A2.2

Reference Organization Statistics

Year	Organization	Kilometres of Gas Pipeline	Kilometres of Hydrocarbon Liquids Pipeline	Total Kilometres
2000	NEB	25 970	13 220	39 190
2000	OPS[1]	524 000	249 020	773 020
2000	CONCAWE[2]	n/a	30 800	30 800
2000	CAPP[3]	n/a	176 000	176 000
2000	EGIG[4]	110 236	n/a	110 236
2000	EUB[5]	229 034	16 410	245 444
2001	NEB	26 510	16 170	42 680
2001	OPS[1]	479 800	255 060	734 860
2001	CONCAWE[2]	n/a	n/a	0
2001	CAPP[3]	n/a	183 000	183 000
2001	EGIG[4]	110 236	n/a	110 236
2001	EUB[5]	245 466	16 818	262 284
2002	NEB	26 752	14 803	41 555
2002	OPS[1]	526 007	258 892	784 899
2002	CONCAWE[7]	n/a	n/a	n/a
2002	CAPP	n/a	225 000	225 000
2002	EGIG	n/a	n/a	n/a
2002	EUB[6]	255 032	17 118	272 150

1 U.S. Office of Pipeline Safety, http://ops.dot.gov/stats.htm

2 Western European Cross Country Oil Pipelines 30 Year Performance Statistics, Report No. 1/02 published in February 2002.

3 2002 Stewardship Progress Report - Changing Behaviour - ONE Focus. ONE Direction, published by the Canadian Association of Petroleum Producers in December 2002.

4 5th EGIG Report, 1970-2001 Gas Pipeline Incidents, Document No. EGIG 02.R.0058, published in December 2002.

5 Field Surveillance Provincial Summary, April 2001/March 2002, Statistical Series 57, Alberta Energy and Utilities Board, published in July 2002.

6 Field Surveillance Provincial summary, January-December 2002, Statistical 57, Alberta Energy and Utilities Board, published in May 2003.

7 Performance of European cross-country oil pipelines, Report no. 1/03, published February 2003.

A2.2 Data

A2.2.1 Fatalities

The number of fatalities recorded by NEB-regulated companies since 1991 is presented in Table A2.3.

TABLE A2.3

NEB Fatality Data

Year	Company Employee	Contractor	Third Party	Total
1991	0	1	0	1
1992	0	1	0	1
1993	0	0	0	0
1994	0	1	0	1
1995	0	0	0	0
1996	0	0	0	0
1997	0	2	0	2
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	0
2001	0	0	0	0
2002	0	0	0	0

Comparative data is provided by source organization in Table A2.4.

TABLE A2.4

Comparative Fatality Data (Fatalities per 100 Full Time Equivalent Workers)

Year	NEB Contractor	NEB Employee	OGP[1] Contractor	OGP[1] Employee
2000	0	0	0.0173	0.0094
2001	0	0	0.0128	0.0047
2002	0	0	0.0120	0.0041

1 Safety Performance of the Global E & P Industry, 2000 by the International Association of Oil and Gas Producers, Report No. 6.93/319, published June 2001; Safety Performance of the Global E & P Industry, 2001 by the International Association of Oil and Gas Producers, Report No. 6.59/330, published July 2002. Safety Performance of the Global E & P Industry, 2002 by the International Association of Oil and Gas Producers, Report No. 345, published June 2003.

A2.2.2 Ruptures

The number of pipeline ruptures per year on NEB-regulated oil and gas pipelines and their assigned causes are provided in Table A2.5.

TABLE A2.5

NEB Pipeline Ruptures (No. of Ruptures and Causes)

Year	No. of Ruptures	Causes					
		Corrosion	Operation	Third	Natural	Material	Unknown
1991	3	1					1
1992	3	2	1				
1993	1			1			
1994	6	2	2		1	1	
1995	4	4					
1996	3	2			1		
1997	2	1			1		
1998	1		1				
1999	1	1					
2000	1					1	
2001	2	2					
2002	3						3
Total	**29**	**15**	**4**	**1**	**3**	**2**	**4**

Comparative data on ruptures is provided by source organization in Table A2.6.

Comparative Rupture Data by Cause
(% of Ruptures, % or Failures, or % of Incidents)

	EGIG[1] (1970-2001)	EUB[2] (1980-2002)	NEB (1991-2001)	OPS[3] (1997-2001)
Corrosion	15	65	58	26
Third Party Damage	50	9	4	27
Material Defects (Manufacturing)	17	7	8	8
Operational	0	3	15	4
Natural Forces	7	1	12	0
Construction Damage	0	5	0	0
Girth Weld Failure	0	5	0	3
Other	11	5	4	32

1 5th EGIG Report, 1970-2001 Gas Pipeline Incidents, Document No. EGIG 02.R.0058, published in December 2002.

2 Historical Pipeline Failures by Cause taken from the report field Surveillance Provincial Summary, January–December 2002 published by the Alberta Energy & Utilities Board in May 2003.

3 U.S. Office of Pipeline Safety, http://ops.dot.gov/stats.htm.

A2.2.3 Injury Frequency

The raw data used to calculate the injury frequencies of NEB-regulated companies is presented below in Table A2.7.

NEB Injury Frequency Data

Year	Contractor Hours	Employee Hours	Contractor Injuries	Employee Injuries
2000	6 255 390	7 031 437	53	8
2001	1 606 271	4 827 678	43	21
2002	1 357 577	5 103 983	13	4

Comparative data is provided by source organization in Table A2.8.

TABLE A2.8

Comparative injury frequency Data
(# Injuries per 100 Full Time Equivalent Workers)

Year	Source	Contractor Injury Frequency	Employee Injury Frequency	Overall Injury Frequency
2000	NEB	1.69	0.23	0.92
2000	CAPP[1]	0.78	0.35	n/a
2000	OGP[2]	0.4	0.29	0.36
2000	BLS[3]	3.6	3	n/a
2000	PLCAC[4]	2.88	n/a	n/a
2000	COGOA	n/a	n/a	1.06
2001	NEB	5.35	0.87	1.99
2001	CAPP[1]	0.63	0.25	n/a
2001	OGP[2]	0.33	0.26	0.31
2001	BLS[3]	3.9	2.5	n/a
2001	PLCAC[4]	1.25	n/a	n/a
2001	COGOA	n/a	n/a	0.55
2002	NEB	1.92	0.16	0.53
2002	CAPP[1]	0.48	0.23	n/a
2002	OGP[2]	0.22	0.17	0.21
2002	BLS[3]	3.5	3	n/a
2002	PLCAC[4]	1.72	n/a	n/a
2002	COGOA	n/a	n/a	0.56

1 2002 Stewardship Progress Report - Changing Behaviour - ONE Focus. ONE Direction, published by the Canadian Association of Petroleum Producers in December 2002.

2 Safety Performance of the Global E & P Industry, 2000 by the International Association of Oil and Gas Producers, Report No. 6.93/319, published June 2001; Safety Performance of the Global E & P Industry, 2001 by the International Association of Oil and Gas Producers, Report No. 6.59/330, published July 2002. Safety Performance of the Global E & P Industry, 2002 by the International association of Oil and Gas Producers, Report no 345, published June 2003.

3 Table 1. Incidence rates of non-fatal occupational injuries and illnesses by industry and selected case types, 2000, and Table 1. Incidence rates of non-fatal occupational injuries and illnesses by industry and selected case types, 2001, 2002. (Contractor is "heavy construction, except highway", employee is "gas production and distribution".) U.S. Department of Labor, http://stats.bls.gov/.

4 Mainline Contractor Injury Frequencies, Safety Statistics Page from http://www.pipeline.ca/.

A2.2.4 Liquid Releases

The number and relative volume of liquid releases reported by NEB-regulated companies is presented below in Table A2.9.

TABLE A2.9

NEB Liquid Release Data

Year	No. of Releases ≤1.5m^3	No. of Releases >1.5m^3 on all Pipeline Companies	No. of Releases >1.5 m^3 on Pipelines Carrying Liquids	Total No. of Releases
2000	264	1	1	265
2001	48	7	5	55
2002	63	11	11	74

Comparative data on the frequency of spills is provided by source organization in Table A2.10.

TABLE A2.10

Comparative Liquid Release Data on Pipelines Carrying Liquids (Releases per 1,000 km of Liquids Pipeline)

Year	NEB	CONCAWE[1]	OPS[2]	EUB[3]
2000	0.08	0.19	0.59	1.22
2001	0.31	0.42	0.51	1.43
2002	0.74	n/a	1.02*	0.76

* The number of spills as per the new DOT definition is 439 spills. There were 265 spills ≥1 m^3. The frequency of 1.02 is based on spills ≥1 m^3. These figures were taken from the DOT database and may not be 100% accurate.

1 Western European Cross Country Oil Pipelines 30 Year Performance Statistics, Report No. 1/02, published in February 2002, page 48. Spills greater than 1 m^3.

2 U.S. Office of Pipeline Safety, http://ops.dot.gov/stats.htm.

3 Alberta Energy and Utilities Board, correspondence dated 4 April 2003, 20 hydrocarbon liquid releases from crude oil pipelines in 2000 and 24 releases in 2001, correspondence dated 17 December 2003, 13 hydrocarbon liquid releases from crude oil pipelines in 2002.

Comparative data on the volumes of spills is provided by source organization in Table A2.11.

TABLE A2.11

Comparative Liquid Release Data by Volume (Cubic Metres)

Year	NEB	CONCAWE[1]	OPS[2]	EUB[3]
2000	11	360	17 300	510
2001	3 877	1 150	15 580	183
2002	1 236	n/a	14 737*	359

1 Western European Cross Country Oil Pipelines 30 Year Performance Statistics, Report No. 1/02 published in February 2002, page 48.

2 Office of Pipeline Safety Hazardous Liquid pipeline Operators accident Sumary Statistics by year 1/1/1986 - 12/31/2002, U.S. Office of Pipeline Safety, http://ops.dot.gov/stats.htm.

3 Alberta Energy and Utilities Board, Correspondence dated 4 April 2003, Crude Oil Release Volumes for 2000 and 2001.

A2.2.5 Gas Releases

The raw data used to calculate the gas release frequencies of NEB-regulated companies is presented below in Table A2.12.

TABLE A2.12

NEB Gas Release Data

Year	No. of Releases (Total)	No. of Releases (Pipe Body)
2000	23	5
2001	29	1
2002	13	3

Comparative data on the frequency of gas releases is provided by source organization in Table A2.13.

TABLE A2.13

Comparative Pipe Body Gas Release Data (Release per 1000 km of Gas Pipeline)

Year	NEB	EGIG[1]	OPS[2]	EUB[3]
2000	0.19	0.17	0.15	n/a
2001	0.04	0.17	0.18	1.30
2002	0.07	n/a	0.11	0.89

1 5th EGIG Report, 1970-2001 Gas Pipeline Incidents, Document No. EGIG 02.R.0058, published in December 2002.

2 Office of Pipeline Safety Natural Gas Pipeline Operators Incident Summary Statistics by year 1/1/1986 – 12/31/2002, U.S. Office of Pipeline Safety, http://ops.dot.gov/stats.htm.

3. Alberta Energy and Utilities Board, correspondence dated 20 February 2003, 319 Gas Releases From Gas Pipelines in 2001 and 227 in 2002 (G/SG/FG).

A2.2.6 Unauthorized Activities on the Right of Way

The raw data pertaining to activities having the potential to damage NEB-regulated pipelines is provided in Table A2.14.

TABLE A2.14

Unauthorized Activities on the Right of Way (No. of Reported Incidents)

Year	Movement of Vehicles or Equipment over Pipelines		Construction, Landscaping or Grading — No Soil Disturbance		Construction, Landscaping or Grading — Soil Disturbance		Pipeline Contacts		Total
	Landowner	Contractor	Landowner	Contractor	Landowner	Contractor	Landowner	Contractor	
2000	2	2	5	0	12	26	0	2	49
2001	1	1	7	0	14	27	1	0	51
2002	0	2	2	0	7	13	0	1	25

Canada